NAVY MANTECH
Manufacturing Technology Program

Annual Report

Fiscal Year 2004

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Executive Summary

The Navy ManTech Program enables the insertion of technology for the acquisition and repair of weapons systems for the warfighter. To that end, ManTech invests in the development and maturation of the processes for manufacturing. This report provides a summary of the key activities of the Navy ManTech Program during FY04. The report is focused on eight areas:

Overview of Navy ManTech in FY04 presents the status of ManTech's actions in shifting to a new investment strategy to more effectively focus program resources on the most critical manufacturing needs of the Navy. The Naval Integrated Systems Investment Strategy was implemented in FY04 to ensure that ManTech invests in high priority systems early enough in their development to maximize technology transition to benefit our warfighters.

Transitions and Accomplishments offers a summary of the benefits of key ManTech projects in FY04. It should be noted that there were technical achievements on five projects that were New Starts in FY03, illustrating ManTech's emphasis on accelerating "time-to-market". One of these is the development of a simulation model for carrier construction, planning, and sequencing that has been implemented by industry for assessing the feasibility and efficiency of several alternative manufacturing scenarios for CVN 21.

New Starts provides an overview of new ManTech projects initiated in FY04. Consistent with the new investment strategy, twelve of these new projects with a total funding of approximately $6.3M are focused on Program Executive Office (PEO)(Carriers) to address the high priority manufacturing needs of CVN 21. In addition, investments continued for DD(X); the first project was started in support of Joint Unmanned Combat Air System (J-UCAS); initial agreement was reached with the Littoral Combat Ship (LCS) Program Manager for FY05 investment; initial discussions were held with the EA-6B Prowler and EA-18G Growler Program Offices and with the Program Executive Office for Integrated Warfare Systems (PEO(IWS)). Near-term manufacturing technology issues on the EA-6B will likely be addressed in FY05.

Congressional Interest Programs provides a summary of eleven programs amounting to $23.5M funded within other Office of Naval Research (ONR) Science and Technology (S&T) accounts that are executed and managed by Navy ManTech personnel. Every attempt is made to leverage the knowledge and resources for maximum benefit to the Navy. In that regard, it is of interest to note that funding for the Maritime Technology Center is managed by a Navy ManTech Center of Excellence (COE), the Gulf Coast Region Maritime Technology Center, to supplement Navy ManTech "shortfall" requirements at the commercial shipyards.

Leveraging Resources demonstrates the benefit to Navy ManTech and the COEs through resources received from other non-Navy ManTech organizations. With a total FY04 appropriation of $50.4M, Navy ManTech and its COEs benefited from an additional $64.0M from other sources:

Non-Navy ManTech funds received by Navy COEs:	$53.2M
Cost Sharing of Navy ManTech projects by industry and other government agencies:	$10.8M

Outreach covers the actions of Navy ManTech and COE personnel to generate knowledge, share resources, and apply the expertise of the ManTech Program in ways that advance both the

customer's good and the Program's mission. Outreach activities include: senior leadership meetings with PEOs, Program Managers (PMs), senior Navy leaders, industry, ONR personnel, and other government entities; interaction with the S&T and Future Naval Capabilities (FNC) Community; "real- time" information exchange through utilization of Navy and COE Web sites; and end-of-project demonstrations.

Papers and Conferences presents the FY04 technology transfer activities of Navy and COE ManTech personnel including publication of seventy papers, presentations and exhibits at one hundred and twenty-five national and international conferences and trade shows, and publication of newsletters, reports, and other ManTech-related program information.

ManTech Program Highlights describes ManTech's continuing actions to become a leaner and more responsive organization including recent personnel changes; an overview of joint service activities including improved Office of the Secretary of Defense (OSD) attention to the ManTech Program; and a look forward to objectives for FY05 including improved program planning, fiscal management, reporting, and communication with the COEs. This section also provides an overview of the new contracting procedures for all future procurements of the COEs and in particular for the four COE re-competes this year.

The Navy ManTech Program continues as a vital element for achieving the timely and cost-effective transition of new technologies from S&T into producible materiel for the warfighter. Through its ONR staff, COEs, and Industry Partners, ManTech provides the Navy with the resources for identifying and addressing the manufacturing needs for new weapons technologies as well as the repair and re-manufacturing of current systems.

Navy ManTech investments -- enabling industry to produce technologically superior systems for our warfighters

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MANTECH
Manufacturing Technology Program

1. Overview of Navy ManTech in FY04

In last year's report, the Navy ManTech Program introduced the Naval Integrated Systems Investment Strategy. This new strategy, which was implemented in FY04, ensures that ManTech's investments aggressively address the highest priority manufacturing issues of selected Navy acquisition programs early enough in their development cycle to maximize the impact. This sharply focused investment strategy ensures that technology is transitioned to those systems to benefit our warfighters.

Highlights of the strategy are:

- Ultimately 70-80 percent of yearly ManTech Program resources are invested in accordance with this strategy, with the balance supporting Navy ManTech Corporate Investments including the Repair Technology (REPTECH) Program and the Business Enterprise Initiative, consisting largely of the Best Manufacturing Practices Program.
- In close cooperation, the selected Program Executive Offices (PEOs), the ManTech staff, the Navy ManTech Centers of Excellence (COEs), and the key systems integrators work together to identify and prioritize crucial manufacturing requirements to enhance successful execution of ManTech projects and the transition of the resulting technology.
- ManTech Program Officers monitor Office of Naval Research (ONR)'s Future Naval Capabilities (FNCs) on requirements-driven, transition-oriented 6.3 and late stage 6.2 programs of interest to the targeted PEOs to provide expertise on the manufacturing processes needed to implement these new technologies.
- Cost leverage from platform owners and system integrators is encouraged.
- All ManTech projects are evaluated on a yearly basis to ensure investments will pay off and that transition opportunities remain viable.

The Navy ManTech Program has always concerned itself with enabling the transition of technology from Science and Technology (S&T) and the implementation of that technology on a naval weapons system. The new strategy endeavors to improve this process by obtaining commitments from PEOs prior to the initiation of projects. This establishes a direct connection between ManTech and the Navy program offices. The PEOs, Program Managers (PMs), contractors and suppliers are encouraged to participate in an initial concept exploration phase conducted by ManTech, its COEs and contractors. This is an assessment of the manufacturing processing needs of the weapons system. Most importantly, this includes the determination of whether the ManTech project has a high likelihood of successful completion in time to meet the "window of opportunity" for insertion into the weapons system. Balanced with ManTech available resources, highest priority manufacturing opportunities are selected.

Once a series of requirements is identified, an agreement is reached on the degree of participation of the PM / PEO in support of the projects. The goal is for each PM / PEO to provide approximately 25 percent of the resources needed to enable successful completion and implementation of the ManTech projects. Resources supplied may include financial support for the ManTech project itself; funding of Navy laboratory personnel to provide test, evaluation and other services; or, providing personnel with technical expertise and/or management experience to assist the ManTech Program Office in project oversight.

This support affords some assurance that the weapons system Program Manager is truly committed to the successful outcome of the ManTech project. The close working relationship

between the parties provides ManTech with a longer-term view as to whether or not the ManTech project actually results in the implementation of the technology.

In FY03, ManTech began to focus on the needs of the PEOs, selected three initiatives for near-term investments, and began establishing liaisons with other PEO offices for future investments. The PEO areas selected were:

Near-Term:
PEO(Ships) – DD(X)
PEO(Carriers) – CVN 21
J-UCAS

Future:
PEO(Ships) – LPD 17 and Littoral Combat Ship (LCS)
PEO(Subs)
PEO(TACAIR)
PEO(IWS)

FY04 investments were consistent with these selections. As described in the New Starts section of this report, investments continued for DD(X) and CVN 21 and were initiated for Joint Unmanned Combat Air System (J-UCAS). The plan is to continue the investment in CVN 21 and expand the investment in J-UCAS over the next three to four years. CVN 21 was the major investment thrust in FY04 when twelve new projects were started to support PEO(Carriers). These projects were defined in FY03 through an initial study conducted jointly between ManTech and the PEO. The FY03 ManTech investment in CVN 21 was about $2.3M. In FY04, the investment has grown to over $7.2M including $6.3M for FY04 New Starts for a total two year ManTech investment of over $9.5M. During that same period, the CVN 21 Program Office has provided funding of about $2.3M, almost 20 percent of the total $11.8M. The planned ManTech funding for CVN 21 projects in FY05 is $13.8M with an additional $3.3M anticipated from the Program Office.

Other new starts in FY04 addressed requirements of the submarine, aircraft, Marine Corps, and Repair Depot communities. During FY04, initial meetings were held with the LCS Program Manager and agreement was reached to conduct an initial concept exploration during FY05 with the intent of major ManTech investment in FY06. Discussions were also held with the EA-6B Prowler and EA-18G Growler Program Offices as well as with the PEO(IWS). Near term manufacturing technology issues on the EA-6B will likely be addressed in FY05. Balancing limited resources against the many manufacturing needs of the Navy is a continuing challenge.

2. Transitions and Accomplishments

Transition of technology is the primary focus of Navy ManTech. Advances in manufacturing technology are only useful to the Navy if they result in implementation in weapons systems to increase mission capability or reduce cost or both. Transition of manufacturing processes to private and government industrial entities that manufacture and repair systems and components for the Fleet is the goal of every ManTech project.

The following table provides a summary of some of the key transitions and accomplishments during FY04. Each of the entries in the table represents ManTech projects that started in FY03 and prior years. It should be noted that five of the entries are technical achievements on projects

that were New Starts in FY03, illustrating the determination of all involved in ManTech to accelerate the "time-to-market" of technology for use by the warfighter.

FY04 Transitions and Accomplishments

Transition / Accomplishment	Background / Purpose	Navy Impact
PEO(Carriers)		
FY03 New Start: Modeling and Simulation for Carrier Construction Planning and Sequencing: Developed detailed simulation models aimed at assessing the feasibility and efficiency of several alternative manufacturing scenarios for high-valued ship assemblies. Northrop Grumman Newport News is using for CVN 21 planning.	Aircraft carrier construction typically requires seven years and involves over six hundred units and millions of parts. Discrete event simulation tool is used during design to quickly test several manufacturing alternatives. It increases planning process visibility, enables enlightened decisions earlier in the construction process, and drives costs down.	Improved Original Equipment Manufacturer (OEM) manufacturing system cognizance leads to more efficient production and decreased cost due to schedule improvements and reductions in capital investment and labor.
PEO(Ships)		
Dimensional and Accuracy Control Automation: Operational at Bath Iron Works (BIW) reducing dimensional variations of plasma cut parts for DDG 51 construction. The system combines commercial-off-the-shelf (COTS) hardware with specially developed software tools to enable BIW to rapidly collect and analyze dimensional data on production parts.	Shipbuilders estimate that as much as 30 percent of the fabrication costs of a Navy ship are due to additional operations and rework necessary to correct inaccurate parts, improper fit between parts, and welding distortion due to these inaccuracies. This project is continuing to develop new accuracy control tools to reduce the costs for fabrication and assembly of Navy ships, including the DD(X) destroyer.	Improvements in dimensional accuracy of ship construction enhance platform protection through signature reduction and lower construction costs. To date, $252K per hull in cost avoidance has been identified. Cost avoidance of approximately $1.8M is expected over five years with the construction of seven DDG and DD(X) ship hulls.
FY03 New Start: Manufacturing Large Marine Structures: NAVSEA-approved, high-productivity welding processes are being implemented at Northrop Grumman Newport News and Bath Iron Works for the third DD(X) test module.	Integrated intelligent automation with optimum welding processes, consumables, and procedures to replace the manual welding of large, thick, high-strength steel structures. Current manual welding is time consuming and results in distortion and subsequent rework / repair.	Replacing manual welding will reduce labor hours, improve efficiency, and assure first-time quality, resulting in reduced production time and cost. Overall, this will reduce acquisition cost and construction periods for DD(X) and future surface combatants.
PEO(Subs)		
Polycan Fabrication: Reduced lead-time from days to hours. Developed automated capability using a portable coordinate measuring machine to capture polycan profiles. Automated the nesting and Computer Numerical Control (CNC) waterjet cutting processes for the polycan elements. Implemented at Pearl Harbor and Portsmouth Naval Shipyards.	During overhaul of SSN 688 Class submarines, numerous concentric ring polycans are fabricated. Current process is manual and labor intensive requiring up to 5 days to complete. Each layer is custom fit using tight tolerances. The forming process, distortions during the fit up, and the welding process cause inaccuracies at assembly.	Polycan Toolkit process developed under this project helped remove this repair procedure from the critical path for Los Angeles Class Submarines. New process reduces labor required by 50 percent, reduces material required by 30 percent, improves safety by getting workers off the band saw, and maintains / improves quality.
FY03 New Start: Cluster Based Manufacturing Through Integrated Product and Process Simulation: Designed and developed a platform independent process modeling methodology. Methodology has been transferred to Electric Boat and is currently being utilized.	In existing operations, excessive, non-value-added time is spent in material movement and setup, and in locating resources. Primary contributor to inefficiency is facility layout and material flow into work cells. Visualization tools rapidly generate alternative assembly sequences.	Decreasing the learning curve in manufacturing large units results in a decrease in overall cost, as well as an improvement in product quality.

Transition / Accomplishment	Background / Purpose	Navy Impact
FY03 New Start: Low Cost Submarine Cover Plates: The integrated bleeding manufacturing process (IBMP) transitioned to Northrop Grumman Newport News' shipyard where the process is being used to manufacture composite parts for Virginia Class submarines and aircraft carriers.	Many Virginia Class access cover plates are manufactured out of steel, and each cover must be individually fitted to the as-fabricated structure. Steel fabrication of doubly curved covers is an "art". The objective of this project was to develop and refine IBMP to reduce submarine cover plate acquisition and installation costs.	IBMP is a cost-effective composite fabrication process for producing highly curved submarine cover plates. Demonstrated that a composite dihedral pod cover can be fabricated in 2-3 weeks using only about 300 labor hours compared to a comparable steel cover that takes 3-4 months and over 2000 hours.
PEO(TACAIR)		
Translational Friction Welding of Titanium Engine Blisks: GE Aircraft Engines has successfully developed and implemented translational friction welding (TFW) and produced welded integrally bladed titanium compressor disks (or blisks) for the GE23 engine. This technology will be used to produce new blisks and repair blisks damaged in service.	The need to continue to improve the performance of the engines that power Navy combat aircraft while reducing life-cycle cost is a demanding objective. One-piece, integrally bladed disks (or blisks) are one of the ways engine manufacturers are meeting this objective. This project developed TFW for application to Navy aircraft engines.	Benefits of TFW blisks include: reducing engine weight up to 47 pounds; reducing cost by 20 percent ($43K per engine); 20 percent increase in thrust; 4 percent reduction in specific fuel consumption; increase in high cycle fatigue strength by 20 to 25 percent; reduction in toxic effluents; and cost avoidance for engine repair and overhaul.
Aircraft Primary Structure Adhesive Bonding Development: Results transitioned to airframe manufacturers for use in the design of components for Joint Strike Fighter (JSF) and future military aircraft. Lockheed Martin Corporation has applied this technology to the JSF inlet duct to produce a seamless, bonded inlet duct for the JSF aircraft.	Adhesive bonded primary aircraft structures can save significant weight and cost in advanced military aircraft compared to the current practice of bonded joints that are reinforced with fasteners. The purpose of this project was to improve the quality and reproducibility of adhesive-bonded joints of primary aircraft structures by reducing the manufacturing variability.	When compared to the conventional design, the adhesive bonded inlet duct for the JSF eliminates 95 percent of the fasteners, reduces weight by 80 pounds, improves aerodynamics and signature, simplifies the manufacturing process, and reduces the cost of this duct by more than $200K.
MMIC Flip Chip: Bumped Monolithic Microwave Integrated Circuits (MMICs) from Raytheon RF Components high-volume bumping line were inserted into transmit / receive modules for the Active Electronically Scanned Array (AESA) radar for the F/A-18. A second source MMIC bumping capability has been established at TriQuint.	The main requirement for this project was to establish a high-volume capability for bumping MMICs sufficient to supply needed Low Rate Initial Production (LRIP) quantities for the AN/APG-79 AESA radar for F/A-18. The production capability at program initiation was inadequate.	This manufacturing improvement results in cost avoidance of $24.6M for the LRIP's 42 systems. This project resulted in an increase in bumped wafer production from 4 wafers per week to 14 wafers per week on the established high rate line.
Marine Corps		
Titanium Howitzer: Demonstrated production of a single piece titanium investment casting spade for the Marine Corps XM777 Lightweight 155mm Howitzer. Implemented in Low Rate Initial Production and Full Rate production. Also demonstrated use of a flowformed tube in the cradle assembly, significantly reducing material waste.	Original production for spade involved bending, welding and machining of 60 different parts. Baseline approach for titanium tube production has been hot finished tube machined to final dimensions. The project objective was to identify, develop, and demonstrate lower cost, robust manufacturing processes.	Conversion to single piece casting substantially reduces manufacturing time and cost resulting in $27M cost avoidance for the Lightweight Howitzer program. In addition, implementation of the flowformed tube in Full Rate Production will reduce the cost of the system by $13.2M.

Transition / Accomplishment	Background / Purpose	Navy Impact
Other		
Technology Refresh for Navy Transformation (TRENT): Identified and accomplished direct data integration between a leading obsolescence identification tool (Q-Star) and a technology refresh planning tool (MOCA). The integrated tool is available for purchase by Government and industry.	DoD weapons systems are increasingly comprised of COTS components requiring a tailored in-service refresh strategy reflecting their different sustainment issues. This project is developing an information technology infrastructure to integrate the processes, information flows, and tools to effectively meet the needs across the supply chain.	Use of integrated tools helps optimize technology refresh schedules, resulting in lower sustainment costs and better producibility of hardware for the Warfighter. The alternate platform obsolescence cost study indicated a possible 10 percent reduction in operation and support costs by implementing a supplier chain-managed technology refresh process.
FY03 New Start: Tin Whiskers Transformational Manufacturing Technology Initiative (TMTI): Identified robotic solder dip process to remove all tin plate and still meet military reliability requirements on a variety of electronic packaging designs and components. Parts are progressing through the electrical testing, solder dip and destructive physical analysis phases.	Electrically conductive "tin whiskers" can develop under typical operating / storage conditions on any product type that uses lead-free pure tin coatings. They have been responsible for an estimated loss of at least $1B in satellites, missiles, and other equipment. This project is confirming a robotic solder dip process as a means of partially mitigating tin whisker risk to high-reliability military electronics.	This project will qualify a technology that will allow military manufacturers to make use of some components that are only available with a pure tin finish and hence provide a rapid Fleet capability improvement by helping prevent interruption and/or stoppage of weapons system production. It is expected that the process will prove effective for about 80 percent of package styles.

3. New Starts

During FY04, the Navy ManTech Program initiated twenty-five new projects encompassing the highest priority needs of targeted Navy weapons systems. Consistent with the new strategy, twelve of these new projects with FY04 ManTech funding of about $6.3M are focused on PEO(Carriers) to address the high priority manufacturing needs of CVN 21. In addition, investments continued for DD(X) and the first new start in support of J-UCAS began in FY04. Other Navy manufacturing technology needs that were supported in FY04 include two projects at the Navy depots, a fabrication project in support of the Special Operations Command (SOCOM), five projects in support of PEO(Subs), one for the Marine Corps, and one Joint Strike Fighter manufacturing feasibility effort.

FY04 New Starts

Project	Background / Purpose	Navy Impact
PEO(Carriers)		
High Strength and Toughness Naval Steels for Ballistic Protection	Preliminary laboratory studies have shown that 10Ni (10 percent nickel by weight) steel has the potential to provide increased protection and/or structural strength at reduced weight. The objective of this project is to evaluate production 10 Ni steel; optimize heat treatment; and analyze material, ballistic, explosion, mechanical, structural, welding, and corrosion properties.	The reduction of weight and the lower center of gravity achieved by this project will enable CVN 21 to meet design requirements for operations and protection. Replacing currently used High Strength Low Alloy (HSLA)-100 steel with high-strength, 10 percent nickel steel for selected ship structures will reduce weight.

Project	Background / Purpose	Navy Impact
Welding Development for 10 Percent Nickel Steel	Early research has shown that 10Ni steel may be easily weldable due to its low carbon content and clean melt practices. The objective of this project is to develop specific welding procedures and optimized welding electrodes that produce welds that exhibit the required ductility and toughness. In combination with the above project, this will provide the opportunity to implement 10Ni Steel on CVN 21.	This project, when combined with the project above, will enable the implementation of 10Ni steel on CVN 21. The development of efficient welding procedures will minimize production costs and will reduce the learning curve for shipyard implementation. The Integrated Project Team (IPT) includes PEO(Carriers) and Northrop Grumman Newport News to facilitate a smooth implementation of the technology by the Navy and the shipyard.
Fabrication of Titanium Components	The objective is to identify, develop, evaluate, and demonstrate suitable manufacturing techniques for titanium naval components resulting in weight reductions for the CVN 21 class of aircraft carriers. Phase I will identify candidate components, evaluate manufacturing options, make a go / no-go decision on follow-on phases, and assess the overall benefits of the project. During Phase II, selected titanium component(s) will be manufactured by domestic titanium suppliers and evaluated. Phase III will address ship production using the demonstration component(s) produced in Phase II.	The expected benefits from an increased use of titanium on aircraft carriers are reduced weight, lowered center of gravity, increased loading capacity, reduced magnetic signature, reduced maintenance, and decreased life-cycle costs. Titanium component(s) will be selected, redesigned, manufactured, and evaluated for use in the CVN 21 ship class. Insertion of the results is expected in FY08.
Low-Manganese, Flux-Core Welding Electrode for Joining High-Strength Steels	The objective of this project is to develop a low-fuming, flux-cored welding electrode to minimize welder exposure to manganese and other fumes while still meeting NAVSEA requirements and shipyard usability characteristics. The expected benefits are an improvement in welder productivity and reduced welder exposure to hazardous fumes.	The successful development of a low-fuming, flux-cored electrode will result in productivity enhancements and improved access to tight areas by eliminating the need for shipyard welders to wear respirators in enclosed spaces. Following qualification testing, PEO(Carriers) and Northrop Grumman Newport News plan to implement the technology.
High Heat Input Welding of Thick HSLA-100 with Reduced Pre-Heat	Preheating High Strength Low Alloy (HSLA) steels is necessary to avoid hydrogen cracking in the heat-affected zone (HAZ). This involves significant labor and electrical costs and contributes to welder discomfort. The goal of this project is to demonstrate that higher heat inputs can be used to compensate for low preheat avoiding hydrogen cracking.	The project will reduce construction cost by significantly reducing the need for preheating with electric heater bars. The labor cost savings associated with installing, monitoring, and uninstalling the heaters is estimated at over $446K per year and the electricity cost savings at more than $161K per year. Northrop Grumman Newport News expects this figure to increase to over $1M per year on CVN 21 construction.
Wireless Automated Diagnostic and Prognostic Equipment on Shipyard Facility Diesel Engines	Northrop Grumman Newport News is leading a project team that includes Northrop Grumman Ship Systems / Ingalls Operations (NGSS) and RLW, Inc. to equip mobile diesel engines with Wireless Automated Diagnostic and Prognostic systems. The main objectives of this project are to minimize equipment failures, lengthen the time between servicing, reduce the life-cycle cost of equipment, and reduce overall maintenance costs on mobile diesel equipment, such as cranes, trains, transports and tugs.	The benefits of this work are realized through cost avoidance in three related areas: the cost of repairing run-to-failure events; lost revenue following a run-to-failure event; and the cost of a preventive maintenance program. As a result of the cumulative effect of these areas, NGSS expects a recurring savings of 30 percent of the company's annual diesel maintenance budget, plus additional cost avoidance by minimizing disruptive delays caused by reliability problems.

Project	Background / Purpose	Navy Impact
Advanced Surface Ship Watertight Enclosures	Standard Navy watertight doors are heavy, offer little fire resistance because of exposed seals, and are expensive to install and maintain. They require frequent maintenance due to poor functioning, corrosion, and loss of water tightness. This project will specify an interior watertight door for the CVN 21 which incorporates advances in materials / manufacturing processes including, but not limited to, stainless steels, titanium alloys, sandwich panels, and highly automated laser cutting and welding processes.	A 25 percent weight reduction of the enclosure will reduce CVN 21 weight by an estimated 62,000 pounds and will increase CVN 21 stability, range, and speed. Reduced installation and maintenance costs, along with reasonable manufacturing costs, will result in a reduction of total ownership costs. Manufacturing specifications for an optimized design of an interior watertight door for CVN 21 will be delivered to PMS 378 at the end of the project in May 2007.
Elimination of Weld Distortion of CVN 21 Heavy Plate Erection Units	The CVN 21 class of aircraft carriers is using different grades and gages of steel than the CVN 68 class. As a result, new fabrication parameters must be established to achieve flatness requirements in foundation assemblies. The objective of this project is to develop, calibrate, upgrade, and validate fabrication parameters that will produce CVN 78 inner-bottom assemblies that meet flatness requirements.	This technology will reduce weld distortion and minimize any subsequent required rework. By working closely with PEO(Carriers), the technology developed under this project will be directly implemented during fabrication of the first production units beginning in 2005.
Laser Welded Lightweight Panel Structure Fabrication and Application	Current design goals for the CVN 21 class of aircraft carrier call for weight and center of gravity (CG) reductions. One possible method of weight reduction is to use stiff, lightweight, metallic-sandwich panels called LASCOR (LASer-welded corrugated-CORe) panels. The primary objective of this project is to establish shipyard use of LASCOR technology, addressing issues such as joint attachment, stud application, repairability, application development, and demonstration. The viability of LASCOR technology will be demonstrated incrementally.	Provided that the LASCOR technology proves to be a viable alternative to support weight-reduction efforts for CVN 21, a 50–100 long ton weight savings could be obtained. For the applications considered, the weight savings coincide with a lower center of gravity. Other potential benefits of LASCOR include reduced life-cycle maintenance costs and increased ship compartment useable volume. The implementation plan is targeted to satisfy the schedule requirements for CVN 21 production.
Availability of SMAW Electrode (MIL-10718-M) Required for Ballistic Performance Requirements	On CVN 78 (the first ship in the CVN 21 class), the MIL-10718-M electrode must be used for all shielded metal arc welding (SMAW) in High-Strength Low-Alloy (HSLA)-100 and High Yield Strength (HY)-100 steels to meet the required ballistic performance. However, the electrode is only available in a 1/8-inch diameter size which has a history of unacceptable rejection rates. Phase I of this project will optimize 1/8-inch diameter and develop 3/32-inch diameter MIL-10718-M SMAW electrodes, thus developing two diameters of electrodes that consistently meet the required ballistic performance in welded HSLA-100 and HY-100 steels.	The primary benefit of Phase I of this project will be consistent availability of two diameters of MIL-10718-M electrodes needed for cost-effective production of naval vessels. These electrodes will provide welds that are capable of consistently meeting the required ballistic performance in welded HSLA-100 and HY-100 steels, as measured by the weld metal strength, ductility, and notch toughness properties. Implementation is scheduled for CVN 21 production with welds scheduled to be made in March 2005 using the MIL-10718-M electrode.
Optimization of Carrier Material Procurement	Carrier construction requires large quantities of many types of material. Some of these require long lead times. Timing of material arrival is critical to production scheduling and cost. The purpose of this project is to determine a material procurement schedule that optimizes the tradeoff between advance investment and storage costs versus the risk of delays.	Accurately and correctly scheduling material availability will avoid costly construction delays.

Project	Background / Purpose	Navy Impact
CVN 21 Composites Applications for Weight Reduction	The objective of this multi-phased effort is to develop optimal panel fabrication processes for large-scale composite structures that provide an alternative, affordable, lightweight, multi-functional composite ship structure capable of meeting weight and other critical performance requirements for CVN 21. The specific objective of the Phase I effort is to conduct a concept exploration study to determine candidate manufacturing processes and materials.	The main benefit is the development of composite manufacturing technology necessary to produce shock, air blast, fragmentation and fire resistant composite components that meet stringent, next generation CVN 21 operational requirements while providing the desired weight savings. Identification of steps required to transition composite ship structure will provide PMS 378 the opportunity to perform tradeoffs between weight / performance benefits and costs.
PEO(Ships)		
DD(X): Advanced Bonding Methods for Steel Structures	The new class of surface ships, DD(X), will have a Special Hull Treatment (SHT) applied, similar to that currently used on other ships. The baseline process for adhering treatment to the hull is very time-consuming and labor-intensive. This project will evaluate paints and adhesives that deliver the required bonding strength while reducing the effort spent applying tiles to the hull.	It is estimated that this project will reduce production costs for SHT tile installation by as much as $3.6M on the first four ships of the planned 56 DD(X) class ships. Development of a successful spray-on application could reduce construction duration and costs by as much as 80 percent from the baseline process.
DD(X): Automated Thermal Plate Forming	Building the next generation destroyer requires curved plates formed by mechanical bending and rolling as well as thermal forming. Current thermal forming is a manual, labor-intensive line heating process used to form both simple and compound curvatures. Quality is highly dependent on the knowledge and skill of the operator. The objective of this project is to develop an automated thermal plate forming (ATPF) system to improve the accuracy of ship components and to reduce construction costs for the DD(X) surface combatant.	Use of an automated thermal plate forming system will increase quality, decrease costs, and reduce production time compared to current processes. Expected DD(X) implementation benefits include 100 percent increase in throughput, 80 percent reduction in rework, 50 percent reduction in direct labor costs, and 75 percent reduction in support labor costs. The prototype ATPF system will be available for DD(X) implementation in the fourth quarter of 2006.
J-UCAS		
Carrier-Compatible J-UCAS Composites Technology Transition: Systems Design and Manufacturing Demonstration	A new family of unmanned aerial vehicles is being developed to fulfill various mission needs, including long range surveillance, communications node, and deep precision strike. Trade studies and engineering analyses have identified promising design concepts, manufacturing approaches, and assembly methods for a lower cost airframe. This project includes a detailed plan for manufacturing of the most promising candidate.	The Joint Unmanned Combat Air System (J-UCAS) air vehicle is under development by competing teams. Cost / benefit analysis of competing technologies is performed and updated. This project is one step in maturing the manufacturing processes needed for affordable airframes.
PEO(Subs)		
Ultra-light Welding System	In submarine construction, simple welds that take minutes to perform may take several days to set up, primarily due to the need to move large and cumbersome welding equipment and cables through confined structures. This project will develop a lightweight system for pulse, gas metal arc welding.	Based on expected workload, Electric Boat expects a cost avoidance of over $300K per year and a time savings of over 5,600 hours. Another $120K per year cost avoidance is expected from the reduction in purchases of materials that support current methods. For the five-year period following the implementation of man-portable units in the shipyard, total cost avoidance of $2.1M is projected.

Project	Background / Purpose	Navy Impact
Product-Centric Facility Design	Structural fabrication constitutes approximately 20-30 percent of the recurring costs for each Virginia class submarine delivered to the Navy. The major objectives of this project are to significantly reduce the construction schedule of Virginia class vessels and achieve a step improvement in the cost of major structural units. Through this project, Electric Boat will use a product-centric approach to design a new structural fabrication facility, optimized for fabricating all types and sizes of structural components. Integral to this facility will be a robotic welding system.	Electric Boat expects to complete a new fabrication facility at their Quonset Point, RI facility during FY2008. The layout will be optimized using a product-centric approach, where production activities will focus on major product families. The project will also improve the efficiency of EB's Programmable Automated Welding Systems (PAWS) by developing software that identifies good candidates for robotic welding.
Alignments and Inspections	The objective is to establish, through direct observation, a baseline time to complete existing alignment and inspection procedures carried out during the maintenance of submarines and to identify technologies and establish goals and metrics for dramatically reducing the time and/or costs associated with these procedures. One method currently under investigation is the Portable Coordinate Measuring Machine coupled with a Laser Tracker.	Based on savings obtained from other shipyards and several case studies where lasers were used, it is reasonable to expect as much as a 200 percent labor savings for alignment and inspection during scheduled shipyard availabilities.
Sand Cast Mold Drying	This Rapid Response project will provide assurance that the mold-drying procedures to be used by the Naval Foundry and Propeller Center will reduce mold moisture below the level causing worm-hole defects in the Ni-Al-bronze castings. A mold-drying scenario that reduces the moisture level in the mold of a problematic sand casting will be determined.	This effort will contribute to an increased likelihood of producing a successful casting during the next manufacturing trial to avoid schedule slippage in the production of the Virginia class submarine. A three-dimensional computational fluid dynamics model will be used to more accurately determine the best drying conditions.
Brush Electroplating	Components exhibiting dimensional non-conformances due to damage, wear, or pitting corrosion are often repaired using the brush electroplating process. This project will reduce time and costs associated with in-situ brush electroplating repair by identifying 'best practice' methods from each of the repair yards and incorporating plating, tooling, and fixturing improvements to develop an efficient process method.	The development of improved plating, tooling, and fixturing equipment is estimated to reduce time and costs associated with in-situ brush electroplating repair by 30 percent while reducing worker health and safety concerns and hazardous material usage.
PEO(TACAIR)		
Advanced Stiffener Technology for Weapons Bay Door	The weapons bay door (WBD) on the F-35 Joint Strike Fighter (JSF) is a complex and highly loaded structure that needs to survive a very dynamic environment. The baseline design is an extremely complex assembly, which is defined by high part count and labor-intensive fabrication, with a high weight penalty and high acquisition cost. The objective of this project is to prove the manufacturing concept and affordability of a weight-efficient alternate design.	The application of this concept to the JSF WBD is expected to provide both weight and cost savings by a reduction in the number of required fabrication processing steps. This project is intended as the critical steps towards a JFS technology insertion plan to improve weight and reduce costs of the vehicle, most importantly for the Short Take-Off & Vertical Landing (STOVL) configuration.

Project	Background / Purpose	Navy Impact
Marine Corps		
M198 Howitzer Mechanism Recoil Testing	The Marine Corps Logistics Base in Barstow, CA repairs and rebuilds M198 Howitzers and transports them to a firing range for live-fire testing. The objective of this project is to provide the Marine Corps with a cost-effective alternative to live-fire testing that results in a significant per test cost reduction and is safer, repeatable, and environmentally sound.	In FY2004, the cost of live fire testing a recoil assembly for the M198 was approximately $5.7K. The estimated cost of hydraulic testing is $80 per recoil or 1.4 percent of a live fire testing. In FY2004, Barstow rebuilt more than 60 recoil assemblies at a testing cost of about $342K. Hydraulic testing cost avoidance is approximately $337K. In addition, live-fire testing takes at least three days versus one hour to fixture and test using hydraulic testing.
Other		
Improved Fabrication Technology for the Advanced Seal Delivery System (ASDS)	Cracking is occurring in the aft section during system operation. Currently, separate components are attached with bonding and bolting. This project is modifying the composite fabrication and assembly processes to eliminate cracking while at the same time potentially improving structural integrity and field performance.	A reduction of assembly process cost is anticipated. The principal benefit accrues from avoidance of expensive and time-consuming repair procedures necessitated by failures in existing articles. PMS 395 has committed funding for the required qualification and certification testing.
CH-46 Gear Repair	Naval Air Depot, Cherry Point scrapped $1.1M of H-46 aft transmission input pinions and sun gears on an annual basis during 2001 and 2002, due to foreign object and other surface damage. By utilizing REM Chemicals “Super Finishing Process”, helicopter gears can be salvaged and re-used with considerable avoidance in procurement and maintenance cost.	Salvaging and re-using 25 percent of these parts by utilizing super finishing will result in an annual cost avoidance of over $250K. Super-finished gears have demonstrated at least a three-fold improvement in surface endurance.
Unique Identifier Joint Implementation Assessment	The OSD Unique Identification (UID) policy requires that every DoD part meeting certain specified criteria have a serial number permanently written on it. To comply with the UID policy, depot maintenance activities need to ascertain how this policy affects their operations and what steps they will take to implement it. The objective of this project is to perform an evaluation of the time and resources required to implement UID at Navy and Marine Corps depot maintenance activities.	The main benefit of this project is that it will provide the Navy a clear set of steps and an accurate estimate of the costs required to implement UID at the Navy's depot maintenance activities. Without this knowledge, UID implementation would take significantly longer and might not meet the implementation deadlines.

4. Congressional Interest Programs

During FY04, Navy ManTech continued the execution and management of manufacturing technology related efforts directed to ONR by Congress. This year, the Navy ManTech staff had oversight of eleven programs amounting to $23.5M in funding. ManTech personnel manage these projects with a focus on achieving the maximum benefit to the Navy from these efforts and, if possible, augmenting ongoing Navy ManTech projects. In that regard, it is of interest to note that funding for the Maritime Technology Center, shown in the table below, is managed by a Navy ManTech Center of Excellence, the Gulf Coast Region Maritime Technology Center. The additional funds supplement Navy ManTech shortfall requirements at the industrial shipyards.

Another example of leveraging benefits to the Navy is the Lean-*Pathways* AirSpeed Aboard CV/CVN project. Initiated in FY04 using funds allocated in FY03, the program involved real-

time improvement efforts aboard Navy aircraft carriers. During an eleven-day underway period onboard the USS George Washington, the Lean-*Pathways* Team, including members of the ship's company, identified 48 opportunities for improvement in the aircraft repair cycle. Lean practices are now being implemented aboard CVN class ships to improve maintenance and supply process flow. Metrics were established to measure readiness, turnaround-time, and man-hour consumption for both current and future CVNs. The assessment of the aviation repair cycle led to recommendations for design improvements that will result in sustained readiness at reduced cost aboard future CVN 21 carriers.

In the table below, the Navy benefit of each effort funded in FY04 is summarized.

FY04 Congressional Interest Programs

Project	FY04 Funding ($M)	Navy Impact
Automatic Generation of Control Programs for Robotic Welding of Ship Structures - AUTOGEN	3.0	AUTOGEN takes design data (CAD), manufacturing processes, robotic kinematics, and workcell geometry as input, producing weld paths, weld accessibility, and robot / torch commands as output. AUTOGEN has successfully demonstrated welding shipyard components in a work cell with a single robot without human intervention. Additional development is necessary to meet shipyard deployment requirements.
Emerging Critical Interconnect Technology (ECIT) Program	3.5	The ECIT Program continues to promote the emergence, refinement, and delivery of new interconnect technologies for military electronics and encourages domestic technology development through cooperative teaming arrangements with military, industry, and academic partners. The goals include the facilitation and rapid deployment of new technology into military applications as well as providing domestic industry partners with an advantage over their global counterparts.
Laser Welding for Shipbuilding	3.5	Cost of traditional Navy ship fabrication is high due to the widespread use of hot rolled structural shapes. Previous Congressional funding was used to develop the basic laser cutting and welding procedures and developing semi-automated manufacturing processes. The continuing effort is refining the laser welding process controls, automating the production process, and performing qualification testing for the laser welding product and process.
Lean-*Pathways* Distance Learning	2.6	The primary benefits of Lean-*Pathways* (LPW) for the Navy are reduced acquisition costs, reduced cycle-time, and integration of enterprise management functions. Phase I effort established a web-based Distance Learning environment. Phase II doubled the number of participants within an LPW deployment cycle and reduced the cycle time by 10 percent. This effort is expanding deployment to additional Navy suppliers critical to Navy weapons programs.
Maritime Technology Center	1.8	Funds for FY04 were directed towards shipbuilding productivity and quality projects in cooperation with Northrop Grumman Ship Systems. Specific projects in lightweight steel construction included: Advanced Coatings, Lean Six Sigma in Shipbuilding, Avondale Process Model, Virtual Environments, Cost of Poor Quality, and Shipboard Applications of Lightweight Steel. A titanium welding project provided an improved process for welding of titanium pipe that reduced the procedure from two-pass to single-pass.

Project	FY04 Funding ($M)	Navy Impact
Photonic Machining Applications	1.0	Short pulse laser materials processing is an emerging technology that can produce substantial cost avoidance in the manufacture of a wide variety of Navy systems. This project addresses the need for high quality holes in fuel injectors to address the fuel consumption issue with Marine vehicles. It also addresses the need for precise cutting and drilling of silicon wafers to improve yield and reduce cost.
Remote Continuous Energetic Material Manufacturing Pyrotechnic IR Decoys	1.2	This project is developing a technology for the safe, economical production of pyrotechnic material for use in DoD systems. The initial application will be in the manufacture of infrared decoy flares used to protect U.S. aircraft. A second application of the technology is its use in producing the Pyrotechnic Torch System currently undergoing field testing as part of the Army's Humanitarian De-mining Program.
Stretched, Broken Carbon Fibers	1.2	Lightweight, continuous fiber polymer matrix composites have provided Navy air vehicles a unique combination of a high stiffness to weight ratio, corrosion resistance, and improved fatigue properties compared to metal parts. This project, a continuation of the Formable Aligned Carbon Tow (FACT®) Composites effort, is pursuing Stretched, Broken Carbon Fiber as a lower cost method for producing the high strength, complex curved parts required for DoD aerospace applications. Benefits include reduced tooling and fabrication cost and reduced product development and cycle times.
Supply Chain Initiative	1.5	The Supply-Chain Practices for Affordable Navy Systems (SPANS) is an ONR-sponsored program with a mission to improve the affordability of Navy acquisition programs by increasing the efficiency of the supporting supply chain networks. Potential projects are vetted through a Technical Advisory Board (stakeholder) council to ensure industry and government needs are met. Weapons Systems Program Offices are encouraged to participate throughout the project period.
Three Dimensional Printing for Manufacturing	1.4	This project is continuing to develop and demonstrate 3DP™ as an economical process for manufacturing limited quantities of parts for the DoD production and repair community. Specific outreach activity is focused on potential users at Navy activities and weapons systems supply chains. Extension of 3DP™ to nickel-based alloys and tool steels has begun with implementation to production planned for the next year. Investigation of aluminum alloy part production by 3DP™ is also underway. Recently, a procurement contract with Naval Undersea Warfare Center (NUWC), Keyport was established for 3DP™ part production.
Titanium Metal Matrix Composites for Naval Applications	2.8	Projects designed to transition Titanium Metal Matrix Composites (TMC) to production for Navy aircraft are underway in landing gear components, reaction links, and arresting hook components. This project is continuing to demonstrate manufacturing maturity of TMC for airframes and propulsion components for use on the F-35.
Total:	**$23.5M**	

5. Leveraging the Resources of Other Organizations

a. Benefits of Leveraging

The Navy ManTech Program has a demonstrated history of results that benefit the warfighter. It has done so even though yearly requirements for manufacturing technology always exceed the

available funds. To maximize the impact of these funds, every attempt is made to leverage resources of other organizations. In particular, the funding of COEs by organizations other than Navy ManTech, and the cost sharing of Navy ManTech projects have the following technical and economic benefits:

- Reduced duplication of effort and promotes two-way communication by providing a mutual focus on specific ManTech issues.
- Enhanced COE technical expertise and national recognition.
- Expanded ManTech business enterprise permitting ManTech to perform selected programs better and achieve improved results.
- Distributed COEs' overhead costs to organizations other than Navy ManTech.

Leveraging also includes the sharing of information and technical talent with other entities. This involves interaction with the Army, Air Force, and Defense Logistics Agency (DLA) ManTech programs and other government agencies and industry on manufacturing developments through the auspices of the Joint Defense Manufacturing Technology Panel (JDMTP). Leveraging of technical expertise is also encouraged among the COEs.

b. Outside Funding to the Centers of Excellence

Outside funding (OSF) supports manufacturing projects executed by the COEs that are **not** funded by Navy ManTech. Over the past several years, the Navy ManTech Program Office has encouraged the COEs to pursue OSF. The variety of manufacturing projects executed by the COEs with OSF broadens their resident technical expertise, increases their current and future customer base, and reduces the commitment on Navy ManTech for support of the COEs' operations. It enhances each COE's stature as a national resource of technology expertise in manufacturing and re-manufacturing. For FY04:

- The COEs received significant outside funding, with some matching or exceeding their Navy ManTech funding, as indicated in the table.
- Five COEs had substantial increases in their OSF from FY03. The Center for Shipbuilding Technology (CNST) increased its OSF from zero in FY03 to $6.2M in FY 04, and the Electronics Manufacturing Productivity Facility (EMPF) increased its OSF by almost 365 percent over FY03.
- The OSF amounted to 106 percent of the Navy ManTech funding provided to the COEs, approximately the same as FY03.
- Of the $53.2M received by COEs from non-Navy ManTech funds, approximately $9.0M was funded from other ONR organizations; $17.0M from various Navy

FY04 Outside Funding

COE*	Navy ManTech Funding ($M)	OSF (Non-Navy ManTech Funding) ($M)
BMP	2.20	6.00
CMTC	6.96	0.37
CNST	4.46	6.20
EOC	5.46	23.91
EMPF	6.46	7.43
EMTC**	2.00	0
GCRMTC	1.00	0.45
iMAST	4.96	3.00
NCEMT	12.96	5.86
NJC***	3.96	0
TOTAL	50.42	53.22

* See the Appendix for the complete name of each COE.
** Navy facility.
*** Although the NJC receives no outside funding directly, its parent organization, the Edison Welding Institute, receives substantial funding. This funding is used to purchase capital equipment and otherwise support the institute and its staff. The NJC has access to the latest welding equipment and facilities at the cost of use only.

Commands; $1.5M from Marine Corps organizations; $8.6M from Army; $6.7M from the Missile Defense Agency; $320K from Air Force; and the remaining $10.1M from other DoD offices, universities, and commercial sources.

Funding was distributed to the COEs through various ONR contracts and other contract vehicles. More details on the sources of outside funding and the programs funded are presented in the Appendix. It should be noted that outside funding does not include funding to the COEs for Congressional Interest Programs.

c. Cost Sharing

Cost sharing of Navy ManTech projects, including funding and in-kind support by both industry and other government entities, is highly encouraged, and is a legislatively mandated source selection criterion for all ManTech contracts. Cost sharing leverages Navy ManTech funding to achieve technical results and, in many instances, builds in an implementation partner.

- In FY04, cost share contributions were $10.8M, or 21 percent of Navy ManTech funding**.** Cost sharing as a percentage of ManTech funding increased by 3 percent over FY03.
- Notably, the National Center for Metalworking Technology (NCEMT) increased its cost sharing from 1 percent in FY03 to 25 percent in FY04, and the Navy Joining Center (NJC) increased from 22 percent in FY03 to 48 percent in FY04.

FY04 Cost Sharing / Leveraging of ManTech Projects

COE	Navy ManTech Funding ($M)	Cost Share ($M)	Percent of ManTech Funding
BMP	2.20	0.3	14%
CMTC	6.96	3.0	43%
CNST	4.46	0.01	0.2%
EO	5.46	0.2	4%
EMPF	6.46	0.7	11%
EMTC	2.00	0.08	4%
GCRMTC	1.00	0.2	20%
iMAST	4.96	1.2	24%
NCEMT	12.96	3.2	25%
NJC	3.96	1.9	48%
TOTAL ($M)	50.42	10.79	21%

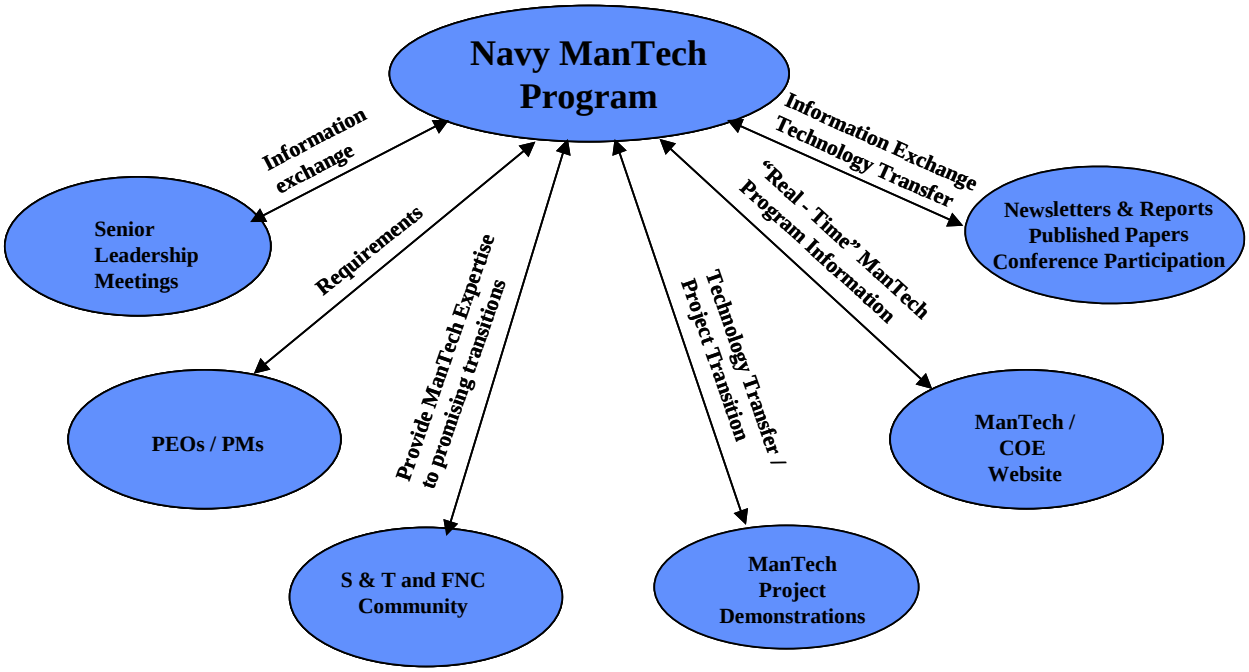
Of the $10.8M in cost sharing, a total of $4.2M was received from major acquisition programs or 39 percent of total cost share - $1.9M from CVN 21 and $2.3M from J-UCAS. This cost sharing by PEOs indicates that the Navy ManTech's shift in investment strategy has the financial support of the PEOs and their commitment to address key manufacturing issues.

6. Outreach

One of Navy ManTech's primary tasks is providing clear, consistent information to its current and future customers. Outreach activities generate knowledge, share resources, and apply the expertise of the ManTech Program in ways that advance both the customer's good and the Program's mission. It is the responsibility of all Navy ManTech Program Officers and personnel from the COEs to perform outreach activities.

As illustrated below, the ManTech organization has many facets of outreach activity to ensure that the program is concentrating its resources on the manufacturing needs of the Navy. In all cases, the focus is on the timely transition of the technology so that it can be implemented by the PEOs and PMs in their acquisition programs and in the industrial organizations that will produce these systems.

Navy ManTech Outreach Activities



a. Significant Senior Leadership Meetings

During FY04, Navy and COE ManTech personnel initiated and participated in numerous interface meetings with PEOs and Program Managers, as well as with senior Navy, industry, and other government agency leaders, to foster an improved understanding of Navy ManTech and our capabilities.

The following table lists a sampling of significant senior leadership meetings.

FY04 Significant Senior Leadership Meetings*

Senior Leadership	Purpose
RADM Jay Cohen, Chief of Naval Research	Discuss future GCRMTC research opportunities
Col Paul Croisetiere, USMC PMA 261, H-53 and Executive Transport Helicopters Program	iMAST Capabilities briefing
CAPT Doty, USN Pearl Harbor Naval Shipyard	Briefing of the iMAST Polycan Fabrication Project Status
BGen T. Waldhauser, USMC / VCNR / CG Marine Corps Warfighting Laboratory	iMAST capabilities brief (at Quantico)
LtGen M. Hough, USMC Deputy Commandant for Marine Corps Aviation	iMAST capabilities brief (at Pentagon)
LtGen R. Kelly, USMC Deputy Commandant for Installations and Logistics	iMAST Facility tour
Mr. R. Kiss, President, Webb Institute	CNST brief to Webb President, faculty, and students

Senior Leadership	Purpose
Mr. T. Ryan, SPAWAR Tactical Links International Program Office	BMPCOE proposed support to PMW 101/159 on Multi-Function Information Distribution System (MIDS) and EuroMIDS (and now Joint Tactical Radio System (JTRS)) for risk management, systems engineering, and Best Practices activities for the Common Link Integration Processing (CLIP) Program.
Mr. R. Rothberg, Program Manager for NAVSEA Commander's Professional Development Program (CDP)	Discussed BMPCOE capabilities and tools as risk reduction activities for NAVSEA Program Management Teams.
VADM P. Balisle, USN Commander, NAVSEA	Systems Engineering / Technical Risk Identification & Mitigation System (TRIMS) for shipyard application.
Maj Gen T. Obering, USAF Deputy Director Missile Defense Agency	Brief on tin whisker risk to MDA systems.
RADM G. Godwin III, USN PEO TACAIR	F-18 MIDS integration
Dr. C. Milligan PEO(Carriers)	CMTC initial discussions on CVN 21 Carrier Island Program
Mr. D. Collins Executive Director Naval Surface Warfare Center (NSWC) Carderock, Philadelphia Division	EMPF resources and the direct support that can be provided to equipment managers. NSWC Philadelphia will sponsor the interface between the Deputy Program Managers for Logistics and the COE.
Dr. M. McGrath Deputy Assistant Secretary of the Navy Research, Development, Test, and Evaluation (RDT&E)	Briefing on the capabilities of the Center of Excellence in Electronics and the potential use of its Industrial Advisory Board (IAB) in support of the RDT&E mission for the Navy.
CAPT M. Huff, USN Program Manager PMW 159, Advanced Tactical Data Systems	Technology transfer to ViaSat of Link-16 findings. This meeting provided a detailed overview of the State-of-Technology Report along with Phase 1 findings that would be beneficial in the development of a smaller, more affordable power amplifier.
CAPT C. Goddard, USN Program Manager PEO(Ships) – DD(X) Washington Navy Yard	Brief on hermetic coating effort in support of the SPY-3 Radar. The objective of the meeting was to obtain concurrence with the program objectives and obtain a funding commitment to leverage the proposed ManTech investment.
Mr. P. Duncan, President, Airak, Inc. Mr. S. Tilton, Program Engineer Prototype Productions, Inc.	Optical Sensor and manufacturing issues regarding Navy requirements for optical sensor systems, with respect to ManTech
Mr. J. Becker Special Assistant to the Under Secretary of Defense	Interest in and feedback on the Navy ManTech TRENT program with respect to the Diminishing Manufacturing Sources and Material Shortages (DMSMS) Center of Excellence overseen by Mr. Becker.
L. Fransiconie Vice President, Raytheon Company and President - Missile Systems	Discussions on missile program support
Mr. A. Divens, PEO(Ships) Dr. R. Vogelsong, NAVSEA Mr. R. Nix, NAVSEA / NSRP	Brief to the staff of PEO(Ships) to explain the CNST program and obtain recommendations regarding platforms on which to focus CNST project funding

*Note: Titles shown are positions held at the time of the meeting

b. Outreach to the S&T and FNC Community

During FY04, ManTech Program Officers continued monitoring ONR's Future Naval Capabilities (FNCs) on requirements-driven, transition-oriented 6.3 and late stage 6.2 programs that fit within the new ManTech investment strategy. Often these S&T programs have promising technology in need of process advancements before transition can be achieved. Where complementary, ManTech can provide expertise in solving the process technology issues associated with the new FNC products, particularly those issues impacting product affordability and, therefore, successful transition to the Fleet. The table below presents a sampling of significant outreach meetings with the S&T and FNC community.

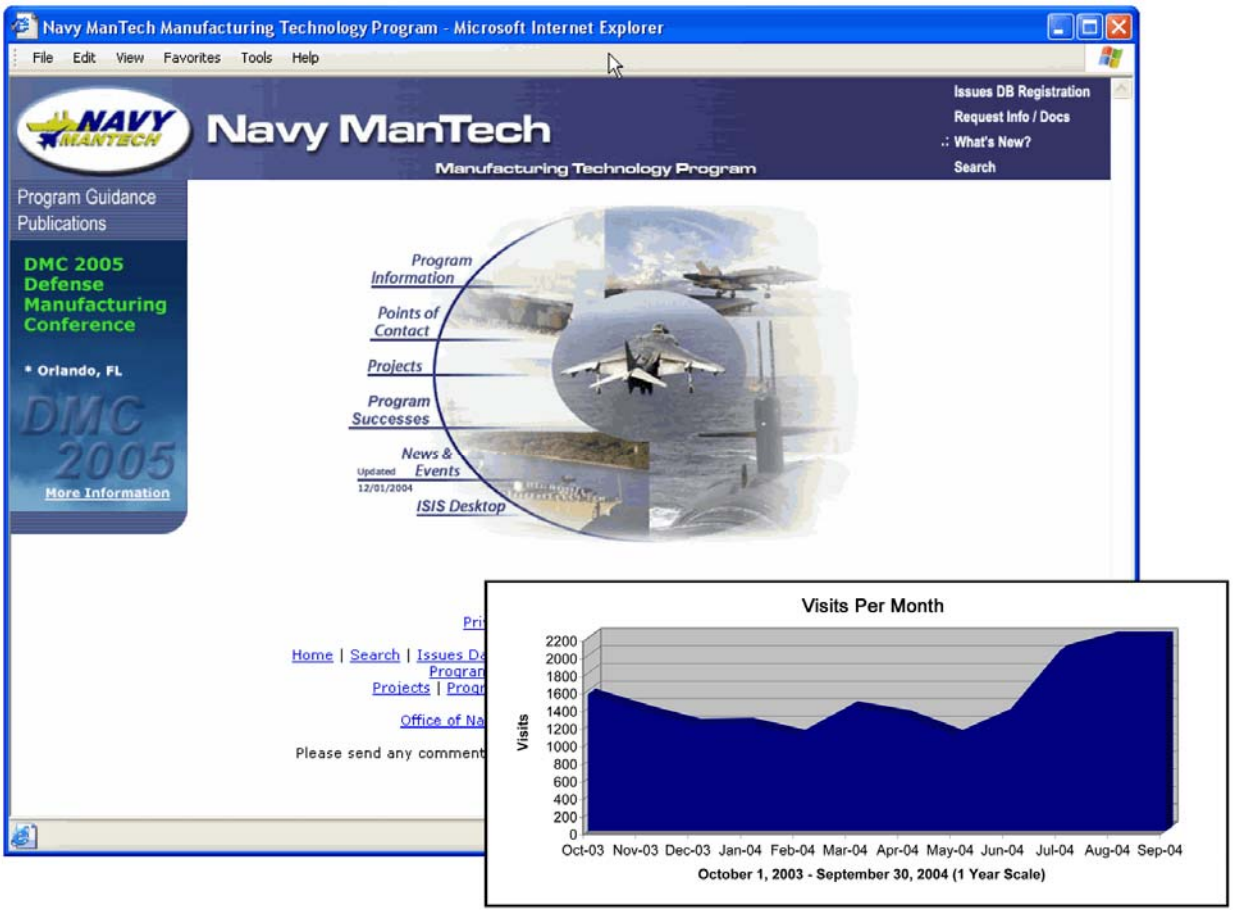
Outreach to the S&T and FNC Community

Organization	Purpose
Dr. R. Pohanka, ONR Total Ownership Cost FNC	Seabase Sense and Response Logistics. iMAST received recommendation for S&T funding
Dr. H. Guard, ONR Capable Manpower FNC Ms. L. Torres, ONR Expeditionary Logistics FNC	Seabase Sense and Response Logistics; iMAST received recommendation for S&T funding
Dr. J. Christodoulou, ONR Program Manager, Ship, Submarine, and Hydrospace Materials	Review of NJC and ONR project activities and coordination of efforts. Areas of common interest were identified as friction stir welding, arc welding, and laser processes; as well as work on use of titanium and 10 percent nickel steel.
Mr. R. Crosson, NIST	Provided BMPCOE Collaborative Work Environment (CWE) capabilities brief and established relationship for future work.
Dr. Yapa D. S. Rajapakse, ONR Code 332 Program Manager, Solid Mechanics	Identify areas where S&T effort could transition into ManTech Projects. Agreed to maintain S&T / ManTech awareness interaction and participate in annual composites workshop.
Mr. G. Stimak, ONR 334 Ship Hull, Mechanical & Electrical Systems	Discussed potential ManTech Projects for CVN 21 island as advanced material S&T transition opportunity. Developed portfolio of potential S&T ManTech CVN 21 Island transition projects
Mr. L. Christodoulou Program Manager DARPA Advanced Materials Programs	Discussed potential use of amorphous materials being developed under joint ONR S&T / DARPA funding for passively cooled jet blast deflectors on aircraft carriers.
Dr. Fritz Kub, NRL 6880, Electronics, Mr. Steven Binari, NRL 6852, Electronics	Discussed wide-band-gap packaging and application issues.
Dr. Harry Dietrich, NRL Detailee to ONR 312, Electronics Division	Discussed issues with pursuing hermetic die for RF (radar) applications.
Dr. S. Lubard Technical Director Office of Naval Research	Briefed on the mission and capabilities of the EMPF and attempted to garner feedback relative to the future direction of ONR.
Dr. B. Junker ONR Department Head, Information, Electronics and Surveillance Capt. M. Huff, USN Program Manager, PMW-159, Advanced Tactical Data Systems	Discussed concepts of leveraging ONR investments in RF components with the needs of the Link-16 MIDS power amplifier affordability program.

c. Utilization of Navy ManTech and Center of Excellence Web Sites

An additional mode of technology transfer / outreach to current and potential ManTech customers is the utilization of the Navy and COE Web sites. Web sites provide users the opportunity to obtain relevant ManTech Program information including the ManTech investment strategy, ManTech project-related information, future ManTech events (seminars, conferences, and demonstrations), proceedings from past events, COE descriptions and links, as well as key ManTech points of contact for obtaining program assistance. Web site utilization also provides COEs with useful data on potential new customers.

- During FY04, the Navy ManTech Program and COE Web sites received a total of 3.6 million hits. This represents an increase of 100 percent over FY03 Web site utilization and is indicative of the improved information / technology transfer being provided to users.
- During FY04, several COE Web sites were enhanced to include current COE events, technical articles and ManTech success stories, meeting presentations, and sources for technical publications.
- Additionally, the DoD ManTech Web site, with links to the other Services and Navy COEs, received a total of 562,384 hits.
- The figure illustrates the monthly Navy ManTech Web site utilization.



As a result of COE Web site utilization:

- The Navy Joining Center (NJC) received a total of 217 technical inquiries.
- The Electronics Manufacturing Productivity Facility (EMPF) COE web site hits resulted in 756 requests for technical publications, 873 Helpline requests, 226 e-mail inquiries for additional information regarding EMPF services, and 366 requests for training center information.

d. ManTech Project Demonstrations

The prime responsibility of the Navy ManTech Program is to assure that technology from successfully completed projects is transitioned to the customer and throughout the DoD Industrial Base. One method of transitioning technology is the end-of-project demonstration. This may also include interim demonstrations of major technical achievements prior to the end of a project.

During FY04, Navy COEs conducted twenty-three ManTech demonstrations. Approximately 415 personnel from Industry, Academia and Government attended these demonstrations. Below are highlights of FY04 project demonstrations:

- **Adaptive Mechanized Welding System**: The Navy Joining Center successfully demonstrated the adaptive mechanized welding system at Northrop Grumman Newport News. This demonstration highlighted the completion of a major project task that applied this technology to welding operations for carrier and submarine construction. The demonstration confirmed functionality of this system to produce real-time adaptive multi-pass groove welds on Navy ship structures. The technology developed during this project will reduce costs, increase reliability, and improve the quality of arc welding operations.
- **Monolithic Microwave Integrated Circuit (MMIC) Flip Chips**: The Electronics Manufacturing Productivity Facility presented reliability data for bumped MMICs, demonstrating adherence to F/A-18 AESA specifications and Raytheon bump specifications. This data proved the high-volume MMIC bump process was reliable and enabled bumped MMICs to be inserted into F/A-18 AESA LRIP.
- **Automated Insertion of Z-Fiber for Complex Shapes:** The Composites Manufacturing Technology Center presented an interim project demonstration of the automated gantry robot insertion of Z-pins into hat stiffened F/A-18 component.

7. Papers, Conferences, and Other Publications

Technology transfer is of prime importance within the ManTech Program. Hence, the Program encourages the writing of technical articles and papers, presentations at, and participation in, professional conferences, and the publication of newsletters and technical reports.

a. ManTech Articles and Papers

During FY04, COE and Navy ManTech personnel published a total of seventy technical papers and articles in twenty-seven different publications. This represents a 43 percent increase over FY03 in published papers. Publications include:

- The Welding Journal of the American Welding Society
- The Journal of Electronic Materials
- The Journal of Cost-Affordable Titanium
- The Journal of Metals

- The Journal of Advanced Materials and Processes
- The Journal of Ship Production

The table below provides a sample of published articles and papers.

FY04 Articles and Papers by Navy ManTech and COE Personnel

Title	Publication	Author(s)
Effect of Oxygen Content on Properties of Cast Alloy Ti-6Al-4V	Journal of Metals	Laurentiu Nastac, Principal Process Modeling Engineer, CTC; William Hanusiak , FMW Composite Systems; Hao Dong, Principal Metallurgist, CTC; F. Robert Dax, Manager, Project Development, CTC
Composites Manufacturing Technology Center - Overview	Polymer Composites III 2004: Transportation Infrastructure, Defense, and Novel Applications of Composites	Gary Schuerfeld, Composites Manufacturing Technology Center
Creating a Reliability Culture in the Maritime Industry	Proceedings of SNAME Maritime Technology Conference & Expo, Washington D.C.	James W. Davis, Strategic Asset Management Inc.; Dr. Bahadir Inozu, Brian MacClaren, and Ivan Radovic, University of New Orleans
The Industrial Advisory Board's Components Consortium: Implementing Data-sharing and Cost Reduction	International Society of Logistics (SOLE) Conference Proceedings	Greg Wood, Linda Britt, Electronics Manufacturing Productivity Facility
Implementation of Lean Six Sigma to Increase Equipment Availability in Shipbuilding	Proceedings of Maintenance and Reliability Conference, Knoxville, TN	Dr. Bahadir Inozu, Brian MacClaren, and Ivan Radovic, University of New Orleans
Modeling and Simulation for Planning and Production	Proceedings of the 2004 Society of Naval Architects and Marine Engineers (SNAME) Ship Production Symposium, Washington, DC	Gregory T. Dobson, Ph.D., UNO; Geoffrey M. Eggert, Ph.D., Bath Iron Works; Joseph Salazar, University of New Orleans
NJC Completes Adhesive Bonding Project for Primary Aircraft Structures	The Welding Journal - American Welding Society	George Ritter and Larry Brown, Navy Joining Center
Finite Element Modeling Discrimination Requirements for the Laser Forming Process	International Journal of Mechanical Sciences	E. W. Reutzel, L. Zhang, and P. Michaleris, Dept of Mechanical Engineering, Pennsylvania State University
Nonlinear Dynamic Analysis of Ship Capsizing in Random Waves	Proceedings of International Society of Offshore and Polar Engineers Conference, Toulon France	Dr. J. Falzarano, S. Vishnubhotla, and J. Cheng, University of New Orleans
Shipbuilding Facility Planning and Design: A Product-Centric Approach (iMAST)	SNAME Maritime Technology Conference Proceedings	Dr. Mark T. Traband, Daniel A. Finke, ARL Penn State; R. Santos, Electric Boat; J. Haffield, Computer Science Corp.
The CFD Modeling of the EB-PVD of SiC/Ti-6Al-4V Coatings	Journal of Metals	Laurentiu Nastac, Principal Process Modeling Engineer, CTC; William Hanusiak, FMW Composite Systems; Hao Dong, Principal Metallurgist, CTC; F. Robert Dax, Manager, Project Development, CTC
TPE Based Gun Propellants with High Nitrogen Modifiers	Joint Army Navy NASA Air Force (JANNAF) 32nd Propellant & Explosives Development and Characterization Subcommittee Joint Meeting	C.D. Knott, Naval Surface Warfare Center, Indian Head Division; C. M. Walsh , Naval Surface Warfare Center, Indian Head Division
STANDARD Missile Value Engineering (VE) Program: A Best Practices Role Model	Defense AT&L Magazine	Roland D. Blocksom, Best Manufacturing Practices Center of Excellence

Title	Publication	Author(s)
Correlation of Subcomponent testing on Laser Diode Array Performance and Reliability	Solid State & Diode Laser Technology Review Proceedings	Jason Carter, David Snyder, Mark Fanton, Bill Everson, Jordan Negley, Charles Shanta, Rick Gamble, David Bernot, Jeff Thomas, Electro-Optics Center
NJC Completes Demonstration Project for Translational Friction Welding of Engine Components	The Welding Journal - American Welding Society	Tim Trapp, Navy Joining Center

b. ManTech Presentations / Participation in Conferences

During FY04, Navy and COE ManTech personnel participated in over 125 conferences and professional meetings. One hundred and six papers were presented at over fifty national and international conferences and symposia including the:

- ONR Navy-Industry R&D Partnership Conference
- Defense Manufacturing Conference
- International Congress on Applications of Lasers and Electro Optics
- Shipbuilding Technology Workshop
- International Military / Aerospace COTS Conference
- World Maritime Technology Conference
- NDIA Science & Engineering Technology Conference.
- Sea, Air Space Exposition, 2004

In addition, Navy ManTech and the COEs had thirty-seven exhibit booths and displays at over forty technical tradeshows and conferences.

c. Center of Excellence Newsletters and Reports

During FY04, Navy COEs published the following:

- Hard Copy Newsletters --- distribution 65,000
- Electronic Newsletters --- distribution 68,000*
- Annual Reports --- distribution 20,000
- BMP Best Practices Survey Reports --- distribution 4,620

*70 percent increase in electronic copies distributed from FY03.

The Navy Joining Center also publishes a monthly Newsletter in the Welding Journal of the American Welding Society with a monthly circulation of 45,000 copies.

d. Navy ManTech Program Office Publications

The Navy ManTech Program Office distributes several technology transfer and informational publications during the year. These publications are distributed at various conferences and technical symposia as well as through electronic transmittals and mailings. A number of these publications are also available on the Navy ManTech Web site.

- The Navy ManTech Annual Report provides information on the ManTech investment strategy; transitions and accomplishments; new starts; leveraging of resources; outreach activities; papers, conferences, and publications; and highlights of future ManTech activity. Approximately 175 hard copies are distributed to senior OSD and Navy Leaders and other senior participants in the ManTech Program. The publication is also available on the Navy ManTech Web site.

- Navy ManTech Program Project Books (CDs) provide users with detailed information on all active ManTech projects – 1,000 distributed.
- Navy ManTech Program Points of Contact Booklets provide information on the Program's Investment Strategy as well as key points of contact within ONR Headquarters and Detachment, the Systems Commands, and Centers of Excellence – 1,000 distributed.

8. ManTech Highlights

This past year has been one of continued transition for the Navy ManTech Program. Actions to implement the new investment strategy have resulted in much closer working relationships with the Acquisition and S&T communities. It has also resulted in a significant workload at the same time the ManTech staff has been reduced. At the close of FY04, a change in leadership of the Program was also announced. These actions, although significant, have remained transparent to ManTech's many customers. Some specific highlights are:

- **Joint Service Coordination:**

  The Joint Defense Manufacturing Technology Panel (JDMTP) is the organization for coordination of the ManTech programs of the Services and the Defense Logistics Agency. During FY04, the panel added the Missile Defense Agency as a full member. In FY04, interaction on manufacturing advancements and needs continued with other government agencies including the Departments of Energy and Commerce, and NASA. Through an industry association representative, the JDMTP and its technical subpanels maintain a communication link to industry and obtain senior industry leadership assistance on the evaluation of broad manufacturing issues.

  Early in FY04, at the annual Defense Manufacturing Conference held in Washington, D.C., the Deputy Under Secretary of Defense, Advanced Systems and Concepts, announced her intention to be the advocate for the DoD ManTech program. Encouraged by this support, the JDMTP continued its reinvention process. The first crosscutting initiative was chosen for a rapid assessment. The Battery Manufacturing Gap (BATTMAN) Study, which was conducted in about four months, resulted in the identification of key manufacturing limitations of military batteries and recommended areas for immediate action. The results were briefed to the Acting Under Secretary of Defense for Acquisition, Technology and Logistics in May resulting in the call for a Defense Science Board (DSB) to assess the potential for ManTech as a mechanism for identifying needs in crosscutting and other areas.

- **Looking Forward:**

  The Navy ManTech Program will continue to implement the new investment strategy with emphasis on improvements in the selection and execution of ManTech projects. Transition of manufacturing technology that results in implementation on weapons systems will continue to be a key program driver. Some specifics for FY05 are:

  1. The focus will be on improved program planning, project execution, fiscal management, program / project reporting, and communication. Industry will be involved early-on to maximize the potential for transition to the factory floor and ultimately to the Fleet, and projects will be incrementally funded so that those not achieving technical and/or schedule goals or those whose transition path has been lost can be rapidly terminated.

2. To foster industry participation with the COEs, revised contracting procedures will be implemented in FY05. These new procedures provide for award fees on technical projects thereby improving industry's incentive to work with the COEs.
3. During FY05, four current Navy COE contracts are scheduled for re-competition: Composites (CMTC), Electronics (EMPF), Electro-Optics (EOC), and Metalworking (NCEMT).
4. Navy ManTech will host the annual Defense Manufacturing Conference in Orlando, Florida on November 28th through December 1st 2005. Extensive planning for this event will be conducted during FY05. The conference draws over 800 attendees from industry, government, and academia.
5. The Defense Science Board on Manufacturing Technology began in December 2004 under the chairmanship of Dr. Jacques Gansler, Under Secretary of Defense for Acquisition, Technology and Logistics from November 1997 to January 2001. It is anticipated that the DSB will conclude its deliberations and report before the end of FY05. The impact on the Navy ManTech Program is to be determined. Navy ManTech personnel, including members of the COEs, will support the DSB as requested.

APPENDIX

a. Abbreviations

Throughout this document, the following abbreviations have been used:

Abbreviation	Center of Excellence
BMP	Best Manufacturing Practices Center of Excellence
CMTC	Composites Manufacturing Technology Center
CNST	Center for Naval Shipbuilding Technology
EMPF	Electronics Manufacturing Productivity Facility
EMTC	Energetics Manufacturing Technology Center
EOC	Electro-Optics Center
GCRMTC	Gulf Coast Region Maritime Technology Center
iMAST	Institute for Manufacturing and Sustainment Technologies
NCEMT	National Center for Excellence in Metalworking Technology
NJC	Navy Joining Center
	Other Projects
LPW	Lean-*Pathways*
SPANS	Supply-Chain Practices for Affordable Navy Systems
3-D Printing	Electronic Based Manufacturing using 3 Dimensional Printing Metalworking Technology

b. ManTech Web Sites

The following table provides the Web addresses for the Navy ManTech Program, the DoD ManTech Program, and the COE Web sites:

Web Site	Web Address
Navy ManTech	https://www.navymantech.com
DoD ManTech	http://www.dodmantech.com
BMP	http://www.bmpcoe.org
CMTC	http://cmtc.scra.org
CNST	http://www.cnst.us/
EMPF	www.empf.org
EMTC	http://www.ih.navy.mil/emtc.htm
EOC	http://www.electro-optics.org
GCRMTC	http://www.gcrmtc.org
iMAST	http://www.arl.psu.edu/centers/imast.html http://www.arl.psu.edu/centers/reptech.html
NCEMT	http://www.ncemt.ctc.com
NJC	http://www.ewi.org/njc

c. Sources of Outside Funding at Centers of Excellence

The following table highlights the sources of, the amount of, and the purpose of the OSF provided to the COEs:

Source of Funding	FY04 Funding ($)	Purpose
BMPCOE		
OASN(RDA) Chief Engineer (CHENG)	$90,000	Implement and support Integration and Interoperability (I&I) assessment plan including identification of assessment risks and mitigation.
Aegis Ballistic Missile Defense (BMD) System	$2,028,248	Support Test and Evaluation Branch on Collaborative Work Environments (CWEs) for reliability and maintainability, configuration management, system integration, radar reliability and maintainability, and mission assurance & safety. Building a Process Based Risk Model for ship installation. Providing program management support. Providing technical expertise in current industry developments and best practices.
PEO Integrated Warfare Systems (IWS 3A)	$1,468,476	Provide support in production, risk management and systems engineering. Conduct failure analysis of Rolling Airframe Missile (RAM) hybrids and recommend process improvements. Provide technical risk management services. Prepare open architecture approach for major upgrade to Vertical Launch System (VLS).
Extended Range Missile (SM-6)	$150,000	Provide engineering, technical, and management support.
Multifunctional Information Distribution System (MIDS)	$276,500	Provide systems engineering, producibility, and risk management analyses for the Joint Program Office (JPO), Link-16 community, and evaluate acquisition strategies and simulation as a tool for rapid introduction of technology.
Missile Defense Agency, Quality, Safety, and Mission Assurance	$496,000	Parts and material selection support; software QA and software council support; RM&QA, producibility, and production support; IDA / Virtual office support.
USMC Light Weight 155 Howitzer (LW155)	$195,125	Assess the production readiness of the LW155 System with the Towed Artillery Digitization (TAD) integration drawing heavily on experience with industry and prior assessment of the LW155.

Source of Funding	FY04 Funding ($)	Purpose
USMC Development of an Expert Knowledge Model to Write Specifications	$224,000	Develop a performance-specification-generator system based on expert knowledge across the DoD to guide acquisition personnel in creating specifications for their requirements.
USMC Highly Expeditionary Long-Range Air Surveillance Radar (HELRSR)	$129,000	Provide independent risk management support.
USMC Ground / Air Task Oriented Radar (G/ATOR)	$199,000	Provide independent risk management support.
USMC Deployable Joint Command and Control (DJC2)	$232,000	Develop a risk management plan and implement the use of Project Manager's Workstation (PMWS) and TRIMS for the DJC2, a major Information Technology (IT) program.
Defense Finance and Accounting Service (DFAS); Corporate Information Infrastructure (DCII)	$125,000	Support the DCII in developing, managing, and hosting a collaborative tool for processing and distributing information to geographically diverse group.
ONR Future Naval Capabilities (FNCs) Collaborative Work Environment (CWE)	$200,000	Support ONR FNC staff in developing, implementing, and hosting a collaborative tool for processing and distributing information to geographically diverse users.
Consolidated Submarine Radio Room (CSRR)	$85,000	Provide systems and production engineering support.
OSD / JDMTP Battery Manufacturing Gap Study (BATTMAN)	$100,000	Assist in assessing shortfalls and risks embedded in current state of Manufacturing Technology affecting the production of military-unique batteries.
Defense Contract Management Agency (DCMA)	$2,000	Provide presentations on BMPCOE and PMWS tools at the DCMA Conference.
CMTC		
Naval Surface Warfare Center - Carderock Division	$144,500	Identify regions of a composite advanced sail for Virginia Class Submarines for placement of internal stiffeners to maximize structural stiffness at minimum weight.
U.S. Army Research, Development and Engineering Command - Natick Soldier Center - Airdrop Technology Team	$77,515	Locating and recommending sources of supply for the key textile-related components of the composite parafoil system, including the canopy fabrics, cordage, webbings and tapes.

Source of Funding	FY04 Funding ($)	Purpose
U.S. Army Research, Development and Engineering Command, Technology Research, Environmental Technology Group; Picatinny Arsenal	$45,000	Research and development for the next generation of U.S. Army Smart Coatings™ materiel for corrosion prevention and control through the use of novel technologies such as nanotechnology.
U.S. Air Force Research Lab, MLMP, Wright Patterson AFB	$100,000	CAI Phase III Integrated and Bonded Structures Validation (IBSV) effort focusing on Materials and Process Validation, Validation of Analysis Methods, Quality Assurance/NDE, and Design Guidelines
CNST		
The Expeditionary Logistics (ExLog) FNC	$6,200,000	Funding for projects that support ONR's ExLog FNC, specifically directed at the shipboard internal cargo movement aspect of Sea Base operations.
EMPF		
U.S. Army Communications Electronics Command, Logistics and Readiness Center	$2,952,288	Re-engineering electro-mechanical parts and improving battery pack on PRC-112 survival radio. Re-engineering and qualifying C-6533 intercom for the Blackhawk and Chinook to reduce total ownership cost and improve performance. Validating production readiness and conducting qualification testing on re-designed C6533A Intercom System for CH-47 and UH-60 rotary wing aircraft. Studying capability of energy storage systems for personnel recovery operations and provide recommendations to improve energy storage systems for survival radios. Developing open architecture COTS version of the ARS-6 for determining survivor's location.
Various Commercial and Military Customers	$1,200,000	Funding received for workforce training and manufacturing services from commercial (80%) and defense industry (20%) customers. Over 200 projects for 123 different customers completed during 2004. Areas included solderability testing, prototype PCB assembly, SEM analysis, manufacturing process development, failure analysis, and cleanliness testing.
Missile Defense Agency, Manufacturing and Producibility (MP)	$200,000	Packaging technologies for phased array radar system T/R modules.
Office of Naval Research, Code 36 - Technology Transfer	$174,000	Facilitate integration of Wide Band Gap Device Technology to Navy weapons systems.
Special Operations Command, Naval Sea Systems Command, Naval Special Warfare (PMS-NSW)	$1,074,989	Integrate advanced Li-Ion Battery technology to the next generation Seal Delivery Vehicle (SDV). This effort will improve the total cost of ownership of the energy storage system on the SDV along with significantly increasing mission length and capability.

Source of Funding	FY04 Funding ($)	Purpose
Naval Sea Systems Command PEO Ships Integrated Power Systems Program	$649,933	Support DD(X) integrated power program including improved thermal management, quick disconnect interfaces for chilled water, modular cabinets for power electronic systems, and investigation of condition based maintenance sensors and technologies for power electronics.
U.S. Army, PEO Soldier, Land Warrior Program Office	$75,803	Improvements to current and future cable and connector system for Land Warrior ensemble.
Pennsylvania State University Applied Research Laboratory	$110,000	Provide support to enable the acceptance by the electronics industry of additive metal processing technologies for circuit boards used in military and commercial systems.
Department of Defense, JGPP Program Office, ITB Contract	$96,860	Qualification testing to assess impact of lead free solder on electronics manufacturing.
U.S. Army Aviation and Missile Command, PEO Aviation Air Traffic Control Program	$893,225	Re-engineer TRN30 navigational beacon for rotary craft in a combat environment to extend service life for an additional 20 years.
EOC		
NAVAIR	$3,736,000	Develop and manufacture high speed fiber optic network components for use on NAVAIR platforms--complementary to ManTech fiber optic projects such as Fiber Optic Interconnect Technology (FOIT)
DARPA	$30,000	Novel Crystals
Missile Defense Agency	$1,900,000	Environment Tolerant Laser Diode Arrays
U. S. Army Research Laboratory	$250,000	Reactive Atomic Plasma (RAP) Processing Phase II
U. S. Air Force Research Laboratory	$220,000	Silicon Carbide Characterization for application to electronic components
DARPA	$53,303	Development of process improvements for new PbSe infrared detectors
NAVAIR PMA 265 F/A-18 Program Office and 4.5.3.3 Core Avionics	$31,602	Navy Infrastructure Study for future facility requirements
Missile Defense Agency	$1,175,000	Development of manufacturing process improvements for infrared focal plane arrays to increase yield and lower cost
Joint Strike Fighter Program Office	$600,000	Develop manufacturing process improvements for large format mid-wave focal plane arrays for the JSF distributed aperture system
U.S. Army Communications Electronics Command	$880,000	Avenger FLIR Upgrade
NAVAIR	$305,509	Surface Damage on SiC Wafers
U.S. Army Communications Electronics Command	$1,053,000	Avenger FLIR Upgrade
Fibertek, Inc.	$669,199	Radiation Hardened Components

Source of Funding	FY04 Funding ($)	Purpose
Carnegie Mellon University	$65,000	Bulk Growth of Silicon Carbide for electronic applications
Fibertek, Inc.	$912,000	Silicon Carbide Optics and Wide Band Gap Reliability
NAVAIR	$1,606,000	Sensor Integration
U.S. Army	$4,715,000	Affordable Night Vision Systems for Multiple Applications
NAVSEA	$400,000	Gallium Nitride Materials and Reliability Development
NAVSEA	$947,000	Chemical Vapor Deposition of High Purity, Low Defect, Bulk SiC and Thick SiC Epitaxial Layers
NAVSEA	$874,000	Millimeter wave imaging--allowing vision through solid objects--for homeland security applications
NAVSEA	$1,940,000	Uncooled High Resolution Infrared Sensors
NAVAIR	$1,550,000	Night Vision
GCRMTC		
Louisiana State Research and Development Group	$29,840	Development of design concept visualizations and potential operation simulation.
Louisiana Incumbent Workers Training Program	$420,000	Conduct Lean Six Sigma training for Northrop Grumman Ship Systems Avondale Operations
iMAST		
Advanced Technology Institute	$73,000	NSRP Panel Project: Laser pipe welding - technology evaluation.
Alcoa Technical Center	$50,266	Laser beam, laser stir, and hybrid welding of aluminum alloys. Laser beam welding of 6013 for fatigue testing.
ARL Penn State Corporate Laser Processing Consortium	$57,000	Laser Processing Consortium '04.
ARL Penn State Corporate Materials Processing Consortium	$10,000	Development and implementation of advanced wear and corrosion resistant systems.
Congressional Interest Program	$240,000	Logistics and cost analysis support for USMC, USA EO equipment upgrades
Department of Energy (Office of Industrial Materials for the Future)	$60,000	Development and implementation of advanced wear and corrosion resistant systems
LanCorp Advanced Systems, Inc.	$17,200	Portable high power diode lasers for removal of interior ship coatings.
MER Corporation	$51,550	Low cost rapid manufacturing process for advanced composites and functional graded structures. Thermal Barrier Coatings (TBC's) support.
NASA, Glenn Research Center	$55,000	Nanolayered TBC for high thermal reflectance and doped TBC for in situ high temperature life prediction and durability evaluation.
National Center for Manufacturing Sciences	$50,000	Integration of laser coating removal for helicopter blade refurbishment.

Source of Funding	FY04 Funding ($)	Purpose
Naval Sea Systems Command, Hydrodynamics Group	$88,000	Trident and 688 propeller lifecycle extension.
Noesis Inc	$42,518	500kW MG Set Repair Survey.
Office of Naval Research, Defense University Research Instrumentation Program	$510,000	Acquisition of a 6 kW Nd: YAG Laser System for laser enhanced fabrication.
Office of Naval Research, Surveillance, Communications, and Electronic Combat Division	$166,060	Advance Technologies for Printed Wiring Board Fabrication Phase II.
Praxair Surface Technologies	$9,982	Effect of gas mixtures on laser weld geometry.
Subcontract from Atlantec-ES for SBIR Phase I Project	$17,000	Develop a prototype surface area calculator program as input to the Paint Planning and Estimating System.
U.S. Army, Program Manager, Ground Combat Systems	$900,000	Battery and hydraulic monitoring systems for HEMTT.
USMC, Program Group Director (PGD 16)	$525,000	Autonomous logistics.
U.S. Army, Greenwood Chemical/Biological Proving Grounds	$100,000	Nanoflakes of TiC and TiB2 for obscurant applications.
NCEMT		
U.S. Army Tank-Automotive Research, Development and Engineering Center	$1,659,869	Develop and demonstrate manufacturing technologies that both reduce weight and improve total affordability of the next generation of combat vehicles. Design a lightweight metallic bridge capable of supporting the military's heaviest combat vehicles over wide gaps in the combat environment. Redesign and fabricate road arms to facilitate the integration of an active suspension system into the Lancer Combat Vehicle.
Naval Sea Systems Command, Metallic Materials Branch (NAVSEA 05M2)	$2,124,958	Metallic Materials Advanced Development and Certification (MMADC) Project: Provide a database for collection and extraction of information to facilitate material selection and provide the information required by NAVSEA Material Selection Requirements (MSR). Characterize and facilitate certification of materials for future applications.
Naval Air System Command - NAVAIR - PMA 299 (Multi-Mission Helicopter Program Office)	$2,073,343	The Dynamic Components Redesign Study will identify H-60 Seahawk dynamic components that do not have an acceptable life, investigate reasons for replacement, and provide recommendations for potential redesign of the selected components. In addition, PMA 299 and SAC will implement the Sonobouy Launcher (SBL) improvements into SAC H-60 production line.

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http://www.navymantech.com